

## SECTION 16060 - GROUNDING AND BONDING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

#### 1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 1. Comply with UL 467.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:



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1. Grounding Conductors, Cables, Connectors, and Rods:

- a. Apache Grounding/Erco Inc.
- b. Boggs, Inc.
- c. Chance/Hubbell.
- d. Copperweld Corp.
- e. Dossert Corp.
- f. Erco Inc.; Electrical Products Group.
- g. Framatome Connectors/Burndy Electrical.
- h. Galvan Industries, Inc.
- i. Harger Lightning Protection, Inc.
- j. Hastings Fiber Glass Products, Inc.
- k. Heary Brothers Lightning Protection Co.
- l. Ideal Industries, Inc.
- m. ILSCO.
- n. Kearney/Cooper Power Systems.
- o. Korns: C. C. Korns Co.; Division of Robroy Industries.
- p. Lightning Master Corp.
- q. Lyncole XIT Grounding.
- r. O-Z/Gedney Co.; a business of the EGS Electrical Group.
- s. Raco, Inc.; Division of Hubbell.
- t. Robbins Lightning, Inc.
- u. Salisbury: W. H. Salisbury & Co.
- v. Superior Grounding Systems, Inc.
- w. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."
- B. Equipment Grounding Conductors: Insulated with green-colored insulation.
- C. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating



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bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Bare Copper Conductors: Comply with the following:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Assembly of Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
- G. Copper Bonding Conductors: As follows:
  - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, **1/4 inch (6.4 mm)** in diameter.
  - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
  - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; **1-5/8 inches (42 mm)** wide and **1/16 inch (1.5 mm)** thick.
  - 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; **1-5/8 inches (42 mm)** wide and **1/16 inch (1.5 mm)** thick.

## 2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

## 2.4 GROUNDING ELECTRODES

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### GROUNDING AND BONDING



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- A. Ground Rods: Copper-clad steel.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. In raceways, use insulated equipment grounding conductors.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

### 3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- D. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

### 3.3 INSTALLATION



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- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
  - B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

### 3.4 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.



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- D. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
  - E. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
  - F. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

END OF SECTION 16060

